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Circulated DAILY, *to every part of the British Territories in India, and delivered* POST PAID, *and Free of all Extra Charges, at a Subscription Price of* TWELVE ANNAS *per Number, or Twenty Sicca Rupees per Month, at the most Distant Stations of the Three Presidencies;—and delivered* DAILY *(Mondays excepted) in Calcutta and its Environs, at a Subscription Price of Ten Sicca Rupees per Month, including all charges.*

Mausoleum at Agra.

(With an Engraving, Plate XXIV.)

The benefits of our endeavours to introduce more generally into India, the practice of illustrating certain subjects by Engravings, have already in many instances been made apparent; and we feel proud of having, even at this early period, collected together some valuable Sketches of Indian Monuments, which would otherwise probably have remained for ever in the Port Folios of those to whom they originally belonged. As there can be no doubt, but that the country abounds with subjects of this nature, we trust that those of our Friends, whose local opportunities must enable them to add largely to our collection, will continue to augment the store; so that in the progress of a few years, our Journal may contain whatever is valuable or remarkable among the ancient edifices of India, whether of Hindoo or Mohammedan construction, as well as the modern public buildings of English design; and that these, added to the cavernous and sculptured antiquities on land, and the charts of newly surveyed islands and harbours of the sea, may, in the course of time, form a body of valuable and interesting documents, worthy of preservation, not only as matters of reference for the gratification of curiosity, but also as a record of the public spirit, and patronage of Englishmen in India, extended towards a Work, whose success has belied all the gloomy prophecies of its rivals, solely because it aspires to the dissemination of those purely British principles which Englishmen can never alienate, in whatever quarter of the globe their lot may be cast.

The Drawing of the Tauje Mahal, at Agra, from which the accompanying Engraving has been reduced, was executed by a native artist; and, as our readers will be aware, is rather remarkable for the accuracy of the minute details of its ornaments, than for fidelity of proportion or perspective, branches of art, in which the natives of India have never yet attained perfection.

As it was forwarded to us by a Friend from another station of the interior, who has not accompanied it with the description which a person resident at Agra might afford, we have contented ourselves in the present instance, with compiling the few short notices of the building within our reach, for the gratification of those who might not be disposed to turn to these authorities if merely referred to, but would yet perhaps be pleased at going over them, if presented at once to their view.

The principal description of this Edifice, known to us at least, is given in a Letter from Major J. H——, dated at Agra, June 18, 1794, and inserted among the Miscellaneous Tracts, at page 73, in the Asiatic Annual Register for 1803.

The Tauje Mahal is a very superb and splendid Mausoleum, built entirely of white marble, situated on the southern banks of the Jumna, about three miles from the Fort of Agra. The ground on which the Mausoleum is built, is raised upwards of thirty feet above the level of the river when full. It is enclosed within a space of 300 yards long, (running upon the banks of the river) and more than 120 feet in breadth.

The whole is encompassed by a very high and thick wall, faced with red stone, within this wall there are four small bastions, one at each angle, and also the same number of small octagon buildings, consisting of three stories and a cupola at the top. In these, Major Palmer and his Officers live when at Agra.

Twenty feet within, and from the edge of the first pavement, a second floor is raised eighteen feet high, which is built of white marble, and forms a square of upwards of 300 feet. A gallery of eighteen feet wide runs round the whole of this pavement. This is divided into a number of small apartments, which are lined and paved with white marble.

There are four minarets, built of white marble, inlaid with streaks of black at the joinings; you ascend by a winding staircase to the top of the cupola, from whence you have a commanding view of the Fort of Agra, and the ruins of the suburbs. In the staircase are three landing places, and in each of these a balcony, under and round which runs an inlaid handsome border. These minarets are placed at the four extreme angles of the second raised pavement. You ascend this pavement by a flight of steps, which fronts the centre and largest walk in the garden, and directly opposite to the entrance of the Tauje itself.

The Tauje is nearly 190 feet square. There are four fronts, exactly alike, 140 feet each, and the taking away the angles reduces it to an octagon of unequal sides. The dome rises from the centre, and may be 70 feet in diameter. The whole of the outside is of white marble, ornamented round the doors, windows, and bottom of the Tauje, with painted patterns of flowers. Round the door by which you enter, are engraved a variety of Arabic inscriptions; the letters are large, remarkably well cut, and made very legible by by being coloured black; in the centre of each of the four fronts, there is a large arch thrown over each of the doors, through which light is admitted to the vestibule. The entrance is by the south arch, which leaves a space of half that in breadth. This is the outer vestibule, and at the end is the door by which you enter the inner one, built of white marble, ornamented ten feet high with an handsome filagree border of the same.

You now enter the inner room, which impresses the mind with sensations of awful grandeur and solemnity; it is an octagon of equal sides, twenty four feet, the whole covered by a dome. There is a fretwork projecting, which extends round the walls; this is inlaid with stones of various colours and shades, such as agate, porphyry, &c.; these are thrown into patterns of flowers. All the windows are of the gothic order,* the heights of which are at least 18 feet. These arches are ornamented all round with Arabic inscriptions. The letters are large, legible, and incomparably well cut. Above these arches, runs a cornice; and over those again are 8 smaller arches, with a latticed window in each.

The fronts (two) are enclosed by an octagon railing; this is composed of different compartments made of open work of white marble; the whole enclosed in a frame of white marble, with beautiful flowers of various coloured stones in fancy patterns. At the entrance of this railing, there is a door-way and a false door directly opposite, which is finished in the highest taste, and ornamented as above. The dome and the inside of the room is entirely of very fine polished white marble. In each of the arches are doors; also to the four larger ones; and the whole arch as well as the small door in the centre, is filled up with small frames of glass. In the four smaller ones the door is only glazed.

The Begum's or Empress's Tomb, is raised nearly in the centre, inclosed by the railing; it is less than Shah Jehan's, which is close on the left side of it. The Tombs are of beautiful white marble, inlaid with agate, &c. The patterns of the flowers are elegant, and extremely delicate. Great taste and superior judgment is displayed by the manner in which the variegated tints and shades are arranged. The pavement is in squares of white marble, inlaid with lines of black.

Under the room I have just attempted to describe, is another, to which you descend by a flight of marble steps, (about 40) under a vaulted roof of white marble. In this vault the bodies are buried, and the Tombs raised over them are *exactly* under those *above*. These are likewise of the same materials and workmanship as those above; the roof is vaulted and of white marble, the light is thrown in from above, entering only from one end; this produces a fine effect, and makes the marble appear extremely beautiful, delicately white, and the flowers cannot be sufficiently admired.

Round the principal room already mentioned, there is a suite of apartments, that communicate by passages with the inner, viz. on each of the four cardinal points, there is an inner vestibule; and at each of the corners, an octagon room, communicating by passages, with the vestibules on two sides and with the principal room in the centre. These are good sized, (24 feet) with three windows each, faced with white marble, and pavements of the same; on the outside, and at the top of the dome, there are two gilt balls rising one above the other, and at the top of these a large gilt crescent.

On the outside of the Tauje, and on the first pavement, there are two large handsome buildings, directly fronting it. These are faced with red free stone, intermixed with white, and the parts ornamented are of Mosaic fashion. That to the westward on the left is a mosque paved with marble.

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* The distinctions between the Gothic and Saracenic Orders of Architecture were not so well known to this writer as they are at present; and like many others he has no doubt been led to consider them as one, from their both possessing the pointed arch, which is, it is true, one marked feature of resemblance; but it is equally true, that it is almost the only feature common to both, and that the Orders differ as widely from each other, as the Tuscan and the Composite, or the Doric and the Corinthian.—EDITOR.

and common stone; it has an handsome small railing at the further end, and three neat niches in the sides. That to the east, is called the Jummaul Cawn,* where the priests, &c. used to assemble previous to going to the mosque.

To the southward of the Tauje, there is a garden about five feet lower than the first pavement, and a railing runs along the end of the Tauje, and a little distant from the pavement. In this garden there are abundance of grapes, variety of fruits, and very fine trees; the walks are broad and all paved with flat stones. A marble reservoir is built in the centre, and raised near six feet above the level of the garden; it is a square and has a flight of steps at either side; the fountains were out of repair, and the water I understand to be supplied from the river.

The walk from hence leads to four different directions, and there are some rooms built of red free stone on the wall which incloses the garden. The gateway is to the south, and fronts the Tauje; it is on the same plan, only on a smaller scale, with that at Secundra, the materials are principally of red free stone; the roof is arched, and the hall is upwards of forty feet square. On either side, there are apartments formerly occupied by Faqeers who lived on Shah Jehaun's bounty, these are now going fast to ruin.

Beyond this gate there is a spacious Court, called the Jellaul Kaunah,† built of red stone, with arched apartments for servants, and those attached to the King; it now serves as a barrack for Major Palmer's sepoys. Near this, inclosed with walls, are four other tombs, said to contain the remains of four favorite princesses belonging to his seraglio. Beyond the Jellaul-kaunah is the choky, which in those days was considered as a place of security for merchants and travellers; they are small brick buildings. I did not pitch my tent whilst at Agra, but lived in a small building, in which Mr. Palmer usually resides.

This famous building was began in 1631, the year the Begum died, and it was entirely finished in 1642, at which time Shah Jehaun returned from Lahore; consequently the Tauje was not more than eleven years building, from the time the first stone was laid.

On the northern banks of the Jumna, and directly opposite the Tauje, are the ruins of an inclosure of the same size, as already described. This was intended for Shah Jehaun's tomb, and a communication was to have been made between it and the Tauje, by throwing a bridge over the river. This, however, he was prevented from accomplishing, by his son Aurungzebe, who deposed his father and confined him in the Fort of Agra; there he lived a prisoner seven years, and at his death, Aurungzebe buried him close by the side of his favorite Sultana.

To this account we have only to add, that Dow, in his History of Hindoostan, states, that the sums expended in the construction and ornamenting of this superb Mausoleum, amounted to sixty lacs of rupees, or seven hundred and fifty thousand pounds sterling, which is easily credible after reading the description of its magnificence.

We learn with great satisfaction, that the whole of the Edifice has been within these few years, completely repaired, as well as the fountains in the gardens, and that it is still classed among the most beautiful of the existing monuments of Indian architecture.

* Probably *Jámihh-Khánah*, the place of assembling. Ed.

† *Jalál*, in Arabic is majesty, power; it should probably be *Jálu Khánah*, the Persian name for an out-house. Ed.

Steam Engine.

Soon shall thy arm, unconquered Steam! afar
Drag the slow barge, and drive the rapid car;
Or, on wide waving wings, expanded bear
The flying chariot, through the fields of air.——Darwin.

It has been said of Antiquities, Poetry, and the Fine Arts, that they are the luxuries of learning;—and of Science, Mechanics, and practical Philosophy, that they are the solid food. We know that the last is essential to the support of our existence; but no one will deny, that such existence is rendered, if not more extensively useful, at least more agreeable, and consequently better worth preserving, by the judicious intervention of the first also.

We are happy thus to mingle both, in the proportions which their relative importance deserves, whenever we sit down to prepare a feast of mental entertainment for those who honor us by assembling round our board; and with this feeling, we have considerable pleasure in introducing to their notice, an Original Paper, that has been prepared expresssly for our columns, and forwarded to us with a Letter, too flattering to ourselves to be affixed, but not the less gratifying to be read by us in secret.

We may repeat, however, what we before said, that proofs pour in upon us daily, (if proofs indeed were wanting) of the beneficial effects of devoting a portion of our labours to the cause of Science, Literature, and the Arts, as this Paper was drawn up expressly for our Journal, by a gentleman to whom the subject is familiar, and, who has conceived that efforts, such as we have made, to give a higher tone to the Indian press, and make it something more than a mere retailer of English news, should be met by a corresponding feeling on the part of that community for whose gratification its columns are filled, by whose contributions they might be essentially enriched, and through whose cordial co-operation and support, it may progressively attain a higher and a higher rank, until it blush not to aspire to equal the press of our native land.

This subject of the Steam Engine has been chosen, as one probably less generally understood than any other branch of modern Science—even among men of education in this country, tho' the extensive—nay almost universal application of it in Europe, has nearly superseded every other mechanical power wherever it can be used; and it is consequently a subject of continual recurrence, both in reading, and in conversation.—The circumstance of their being at this moment more than one of these "Giants of Mechanism," as they have been elegantly yet appropriately termed, to be seen at work in Calcutta, adds a local interest to that which it must always permanently excite; and we therefore feel confident, that those who will give themselves the trouble to go through the interesting details into which this Paper of our Friend enters, will rise from the perusal of it with increased information and expanded hearts; the former from the study of Nature, and the wonderful combinations which Art has been enabled to accomplish, in multiplying the application of her powers to the increase of human happiness; and the latter from the contemplation of that wisdom and beneficence which first created such powers for the use of man, and then gifted him with the talent to develope progressively their properties, and make the discovery and the application equally a source of benefit and pleasure.

In order to do justice to the merits of the invention of the Steam Engine, and to exhibit its vast powers and importance, it will be proper to take a brief review of the progress of the several means employed by mankind, in aid of the laborious processes attendant on the necessaries and comforts of civilized life.

The implements employed for pounding or grinding corn, are of high antiquity, and were undoubtedly the first used by mankind, as being indispensable to the preparation of their food. It is most probable, that the first instrument used for this purpose was a mortar, in which the corn was merely pounded, and which by degrees passed through the several stages of improvement it was susceptible of, till it was lost in the hand-mill, and then into that of the mill, driven by men and cattle. The march of improvement in the early ages was slow, for although Abraham caused cakes to be baked for his guests of the 'finest meal,' and that the manna was ground like corn, (1) by which it is clear, that the hand mill was in use in his time, yet was the grinding of corn by hand-mills and mills worked by men, used in Rome up to the time (and long after indeed) of Mithridates, Julius Cæsar, and Augustus, (2) when for the first time mention is made of a water-mill.—Antipater, who lived in the time of Cicero, says, "cease your work, ye maids, who laboured in the mill; sleep now and let the birds sing to the ruddy morning, for Ceres has commanded the water nymphs to perform your task; these, obedient to her call, throw themselves on the wheel, force round the axletree, and by these means the heavy mill."

This date assigned to the invention of the water-mill is, in spite of the quotation just made, disputed by many, who refuse to the ancient Romans all knowledge of means beyond that of men and animals to grind their corn, as it is certain that long after this period, slaves were doomed to labour in the mills of Rome, and that a number not less than 3000 were constantly employed in this drudgery. It is, however, of no great moment, whether it be a century one way or the other; and therefore at about the birth of Christ, or during the century which preceded it, will be admitted without controversy, as the period at which the invention of the water-mill occurred.

Water-mills began, however, only in the fifth century to be in common use all over Europe, and it was not till the beginning of the eleventh century, that wind-mills were invented. In the twelfth century, they began to be more common; but it was not till the thirteenth century, that the governments of Europe assumed the right of interfering in the erection of water and wind-mills, on the plea that they were works essential to the public weal, and the just objects of their care. The greatest encouragement was then given for the erection of mills, securing to water-mills by charter, wherever erected, the whole of the running water within a distance requisite for their purpose, even to "as much as will run through a straw," and to wind mills a similar monopoly to guarantee their success.

The Steam Engine was invented in 1696, and brought to perfection sufficiently to be applied to raising water on the largest scale in 1717, and in 1782 it was brought to its present high state of perfection, than which nothing can be more wonderful. (3)

(1) Anno Mundi 2083.

(2) Anno Mundi 3938, 3944, and 3960.

(3) Mankind knew no power beyond that of men and cattle for 3,900 years at which date, water-mills were invented.

Water-mills did not become common till 508 years after their invention.

Wind-mills were invented 1,200 years after water-mills.

Water and wind-mills were encouraged by charters 1,400 years after the invention of the first, and 200 after that of the latter.

The Steam Engine was invented 400 years after the last mentioned date, or 1800 years after the water-mill, and 600 after the wind-mill.

The Steam Engine was brought to perfection sufficiently to be applied to works on the largest scale, in 21 years, and to its present great perfection in 86 years after its invention.

Having thus shewn, that there are at present known four descriptions of power, *animal*, *water*, *wind*, and *steam*, we shall proceed to point out the very great advantages of the latter over the others. *Men* or cattle (animal power) cannot be brought to unite their strength to very great works, and must necessarily require rest. *Water* is subject not only to floods, droughts, and frosts, which suspend its powers; but as it must necessarily be in hollows, the situation for great works cannot be chosen, and the advantages consequent to proximity are lost. *Wind* is subject to the inconvenience of storms and calms, and diametrically opposite to water, must be on elevations, and alike inconvenient, has no choice of situation. Steam requires but a moderate quantity of fuel and water, to render it superior to every inconvenience: its powers are beyond limit; it is insensible to fatigue; or the vicissitudes of the seasons; and may be placed at the bottom of a mine or on the top of a tower; and the modern application of it is the most valuable gift ever presented by Philosophy and Science to man.

It will be but just in this place to mention the unparalleled benefits which the Steam Engine has conferred on mankind, as a *new power;* a power not discovered by accident, but created wholly by scientific reflection and philosophical research, and available to every possible purpose. It can be made in power equal to the united strength of 200 horses, and which, as it is incapable of feeling fatigue, and works without intermission the whole 24 hours round, is thus equal to 600 horses; or it may be made in power equal to 1 horse, and the number of Engines can be multiplied to any extent at pleasure. There is scarcely a purpose to which ingenuity has not successfully applied it. It extracts water and metals from the depth of 200 fathoms; it propels vessels and carriages; and goes the complete circle of the mechanic arts, from the heaviest to the lightest, sawing, turning, boring, drilling, cutting, polishing, and weaving; working flowers even on the finest muslin. It has enabled Great Britain, in war, to spare a larger disposable force than France, with double her population; and well may we ask, what could we now do without it?

No one has, to our knowledge, had the research to estimate the number and power of the Steam Engines erected in Great Britain; but it may gratify curiosity to mention, that in the town of Manchester alone they reckon 300, and it is probable that every manufacturing district and town in the United Kingdom has fully as many in proportion to its manufactures. Most of the Engines in Manchester are, to our knowledge, of great power, and averaging them at 50 horses each, this would be equal to 15,000 horses, but to do the same work, we must calculate three times that number, or 45,000 horses. Here then is a triumph of Philosophy and Science, which has created a *new power*, obedient to the will of man; a power far beyond that of either animals, water, or wind.

Steam, as a power, depends on the great expansibility of water when heated in a confined vessel. When formed into steam, it occupies 1800 times its original bulk, and is in this latter state an elastic vapour many times superior to the strength or pressure of the atmosphere. The being enabled easily and quickly to produce this increased bulk of water, and to condense or reduce it again to its original dimensions, forms the principle of the action of the Steam Engine.

The honor of the first employment of the agency of steam, as a mechanical power, belongs to the Marquis of Worcester, who, in the year 1663, published his Century of Inventions, or a description of 100 notable discoveries. No. 68 contains a brief description of "An admirable and forcible way to drive up water by fire," (4) which assuredly awards the palm of honor of the invention of the Steam Engine to the Noble Marquis; but more than this, his publication does not appear to have accomplished. No encouragement was given to his discoveries, as he was looked upon as a Projector, nor does it appear that the Marquis ever exhibited to the public his method of raising water by fire.

Although the honor of the invention of the Steam Engine must thus be awarded to the Marquis of Worcester, yet the first actual Steam Engine was made by a Captain Savery in 1696, and from which ought to be dated its origin as a power applicable to the Arts; it being then for the first time shewn to the public to be practicable and effectual. Savery has transmitted his name with his Engine, and if the Marquis of Worcester gave the first idea, Savery has a just claim to the honor of carrying into execution, and rendering practicable, that which for a period of 33 years had been considered improbable and visionary.

Savery's Engine was somewhat similar to a force pump, except that in the barrel or chamber, instead of a piston, a stream of steam from a boiler was introduced, which having displaced the air by its superior elasticity, a vacuum was formed by a jet of cold water thrown into it, whereon the pressure of the atmosphere on the surface of the water intended to be raised, filled the barrel or chamber: on the re-admission of the steam it had first to heat the water, and then to force it up to the height required. It is obvious, that this Engine depending wholly upon the action of very strong steam, the corresponding strength of the apparatus and quantity of fuel requisite to work it, rendered it of very limited use for raising water, the only purpose to which it could be applied.

The next improvement was a gigantic stride in the history of the Steam Engine, and formed the epoch of its prodigious importance to the Arts; as from this period may be dated its origin as a power of unbounded extent. About the beginning of the last century (1705,) Mr. Newcomen conceived the first idea of a Cylinder Engine which he fitted with a solid piston, the rod of which was attached to the end of a scale beam or lever, to the other end of which was fastened the pump rods intended to be worked. Steam being admitted into the cylinder, displaced the air, by its superior elasticity, when a jet of cold water injected, procuring a vacuum, the pressure of the air on the surface of the piston caused it to descend, raising the opposite end with the pump rods, and thus made one stroke of the Engine. Newcomen's idea was not to use the steam as the power, but to procure a void by it's means, and with the air to effect his object; accordingly the pump rods were made to exceed in weight that of the piston, so much as to draw the latter to the top of the cylinder, and we must suppose it in that position previous to the admission of steam in commencing work. A successive raising and depressing of the piston in this manner, formed the principle of the working of the Engine; it being obvious, that a vertical motion thus obtained and attached to the end of a scale-beam or lever would work pumps at the other end proportionate to the area of the cylinder.

Improvements quickly followed, and Newcomen's Engine became universal. New and unthought of enterprizes were, with its assistance, accomplished; and mining in Britain may be said to have but now commenced. For nearly half a century no material improvement occurred, and at length all further attempts were considered impracticable. (5)

In the year 1763, Mr. Watt, of Glasgow, a mathematical instrument maker, having undertaken the repairs of a model of a Steam Engine belonging to the University, commenced a series of experiments from which the most important and splendid advantages have resulted.

Mr. Watt found, that the waste of steam from the jet for the condensation, by the cylinder being cooled at each stroke, was three times more than the quantity required to fill it, and he then conceived the idea of condensing the steam in a separate vessel. His first trial was with a cylinder made of tin plate, and the condensation was so rapid and perfect that the sides of it were crushed in by the air; delighted, with this discovery he quickly procured a stronger apparatus, and pursued his new discovery with ardour and success. He placed his condenser (an air tight metallic vessel) in a cistern of cold water, and attached a pump to it to draw off the condensed steam and to preserve the vacuum as perfect as possible. Seeing the irregularity produced by admitting the air to act on the piston, he closed the top of the cylinder, and shut it out entirely, substituting steam in lieu for the moving power; he afterwards caused the steam to push the piston up, as well as down, which used to be affected by the counterweight at the opposite end of the beam, and thus exerting a pressure alternately on each side of the piston, and at the same time opening a communication from the opposite side to the condenser, he produced a most beautiful regular motion, wholly by steam, on philosophical principles, a pressure on one side, and a vacuum on the other, and keeping at the same time the cylinder at a constant uniform heat, and the condenser at a uniform degree of cold. The perfection of this most ingenious and scientific adoption leaves nothing further to be wished for. Hitherto the Engine might not improperly be called an Air Engine, instead of a Steam Engine, the steam performing the secondary part in the effect only, by merely procuring the vacuum, and the air being the effective agent in creating the power, by its pressure on the piston. (6)

Watt made it really a Steam Engine, working wholly by steam, his improvements therefore embrace three great points, 1st, condensing the steam in a separate vessel; 2d, employing steam to press the piston down; and 3d, employing steam to push it up again. This last, it is obvious, doubled the effect, for if the power was obtained only on the descent of the piston, the return of it to the top of the cylinder being caused by the counterpoise of the pump rods, it could be effective for, but one half of the space moved through, whereas this last is a perpetual propelling power, equal in both directions. In the old Engine, 7lbs. on the square inch of the area of the piston was the usual load the Engine was capable of working with; but as this is little more than one half the pressure of the atmosphere, the difference was attributed to friction. Mr. Watt shewed, that it proceeded from the imperfection of the vacuum, and that it was hopeless to prevent the waste of steam, or to procure a good vacuum, so long as the condensing was effected in the cylinder. His separate condenser, and employment of steam as the prime mover, remedied these so effectually, that his engine worked readily with 12lbs. and was capable of raising 14lbs. on the square inch.

(4) An admirable and forcible way to drive up water by fire, not by drawing or sucking it upwards, for that must be as the philosopher calleth it *intra spheram activitates*, which is but at such a distance. But this way hath no bounder, if the vessel be strong enough: for I have taken a piece of a whole cannon, whereof the end was burst, and filled it three-quarters full of water, stopping and screwing up the broken end, also the touch-whole; and making a constant fire under it, within twenty-four hours it burst, and made a great crack; so that having a way to make my vessels, so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water run like a constant fountain stream forty feet high: one vessel of water, rarefied by fire, driveth up forty of cold water. And a man that tends the work is but to turn two cocks, that one vessel of water being consumed, another begins to force and re-fill with cold water, and so successively, the fire being tended and kept constant, which the self-same person may likewise abundantly perform in the interim between the necessity of turning the said cocks.

(5) It is thought that without the aid of the Steam Engine, we should long ere this have been deprived of the benefit of coal fires, as previous to its invention most of the mines had been worked nearly to the depth they could go without the aid of some Engine of more power and less expence than animals. HUTTON.

(6) It is from this circumstance frequently denominated the Atmospheric Engine.

The advantages chiefly by the saving of fuel were so great, that Watt's Engines rapidly superseded Newcomen's, of which we believe not one is now to be met with. (7)

We will shortly recapitulate the principles of the Engines of Savery, Newcomen, and Watt.

Savery's Engine acted wholly by the force of strong steam, and was of no great use, but must be considered as the first step in the progress of the Steam Engine.

Newcomen's Engine was in principle a cylinder and piston, the latter being raised by the counter-weight at the pump end of the beam, and pressed down again by the atmosphere, on a vacuum being formed beneath it by the condensation of the steam.

Watt's Engine condenses the steam in a separate vessel, and is worked wholly by steam. The condenser being the chief feature of his improvement, in which his Engine differs most materially from Newcomen's, whose cylinder and piston were undeniably the greatest stride in principle towards maturity in the history of the Steam Engine; but the effect of Watt's improvement, by this discovery, is so striking, that with the subsequent ones founded thereon, it presents features entirely new, and forms a still more remarkable epoch in the progress of this "giant of mechanism" towards its present state of perfection, a perfection justly entitled to the appellation of wonderful. (8.)

Having led the reader through a brief history of the principle of the Steam Engine, so as enable him to understand its action, we shall now detail to him the several parts, as far as it is possible, without plates, satisfied that after an attentive perusal, once or twice seeing a Steam Engine will make him acquainted with it.

The boiler for generating the steam is usually waggon-shaped, or circular. The first is considered the best form for the greatest effect of the fuel, and is named from the likeness to a waggon, being an oblong figure with square sides and bottom, and the top dome-shaped like the tilt of a waggon for the formation of steam, and as being the best form for strength. It is set in brick work, with flues circulating round, and in many instances by means of tubes through it, so as to detain the heat and make it deposit its effects wholly on the bottom and sides of the boiler before its escape up the chimney. To prevent accidents from an over accumulation of steam, a safety valve is fitted to the top of the boiler, and a very usual form is that of mushroom reversed, the steam being fitted into a guide to allow it free passage up and down. It is loaded at the rate of 5 or 6 pounds on every square inch of the area of the aperture of the safety-valve; so that whenever the steam becomes strong enough to overcome this pressure, it lifts the valve and lets the steam escape, till it is reduced to the proper standard.

Feeding the boiler with a regular supply of water, is a great desideratum; as too much at a time would check the boiling, while too little would endanger its destruction from the fire. The height at which it ought to be kept is of the first importance, as sufficient room for the steam is requisite on the one hand, and to protect the sides and bottom from the effects of the fuel is as necessary on the other. The limits of its range ought to be small, and the medium line is at about where the sides of the boiler commence their spring to the dome top, the whole of which should be reserved for the occupation of the steam. The feed-pipe is in height about 14 feet above the top of the boiler, the lower end opening under the water, and the upper end being surmounted with a small cistern. The communication from the cistern to the pipe is by a conical or spindle valve, attached to one end of a scale beam or lever, at the other end a wire is fastened, which passing through the top of the boiler, suspends a float of stone or iron at the surface of the water, and the apparatus is adjusted, so that the float shall be at the desired height, being at the same time delicately poised with the valve in the cistern by means of a shifting weight, suspended on the arm of the beam in the manner of a steel yard. It will be easily conceived, that on the lowering of the water by evaporation in the boiler, the float will descend, and depressing the end of the scale beam, lift the other end, and with it the valve, which having admitted a supply of water, the float will rise again with the water and shut it. The cistern is supplied with water by a force-pump worked by the engine.

To discover when the water is at its desired height, and that the feed-pipe apparatus is doing its duty, two pipes with cocks are fitted into the top of the boiler, one having its inner end reaching under the water, and the other above it, in other words the inner end of one connects with the water, and the other with the steam. It is obvious that on opening the cocks, the one will give water and the other steam; should the water cock give steam, it will indicate, that the water in the boiler is too low; should the steam cock give water, it will shew that the water is too high. (9)

As the circulating of the heat through the flues carried round and through the boiler, can be effected only by a high-chimney, a strong draught is a necessary consequence; and as the regulating of the fire is requisite to

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(7) Mr. Smeaton's rule was to reckon Mr. Watt's Engines four times as great in effect as Newcomen's.

An Engine of Watt's construction of the same dimension, and making the same number of strokes of the same extent, does not consume above one-fourth part of the fuel that is consumed by the best Engines of the common form.—Robison.

The great expence of fuel is a great obstacle to the extensive use of the Steam Engine.—Robison.

Every Steam Engine of considerable size costs in fuel £3000 a year.—Hutton.

An Engine of the first size expends 13 bushels of coals per hour, or 11 tons 14 cwt. per day of 24 hours or 4270½ tons per year, which at 50 shillings per chaldron, is £7908 6 8.—Smeaton.

These all allude to the old or Newcomen's Engine.

Watt's remuneration for his invention during the period of his patent, was only one-third of the saving in fuel.

In the case of the large Engine just cited, the annual saving would be to the

Public Stock....................	£. 5931	5	0
To the Proprietor,....................	3164	3	0
Remuneration to the Inventor,....................	1977	1	8

(8) In order to substantiate this claim, we shall enumerate a few of its qualifications. It draws its own water for the use of the condenser, where, having done its office by taking from the steam its heat, it is forwarded for the supply of the boiler, improved by being heated. It feeds the boiler with a minute accuracy, adapted to its exact wants. It manages its own fire, and rings its own bell for coals, should the attendant neglect it. It regulates its own speed, and deals out to a nicety the quantum of steam required, according to the nature of the work it has to perform. In short it approaches nearer to an animal than a machine, and is certainly the noblest drudge that was ever employed by the hand of art. To pursue the metaphor, an indefatigable servant, whose strength has no bounds; of good temper, easily managed, and requiring little attention, yet restive and dangerous if not understood or wholly neglected.

Belidor, speaking of the old Engine, says "It must be acknowledged, that this is the most wonderful of all machines, and that nothing of the works of man approach so near to animal life. Heat is the principle of its movement: there is in its tubes a circulation like that of the blood in the veins of animals; having valves which open and shut in proper periods; it feeds itself, evacuates such portions of its food as are useless, and draws from its own labours all which is necessary to its own subsistence." What would Belidor have said of the more perfect Engine of the present day.

Doctor Black calls the Steam Engine "the master-piece of human skill."

Darwin says Soon shall thy arm, unconquered Steam! afar
Drag the slow barge, and drive the rapid car
Or on wide waving wings expanded bear,
The flying chariot, through the fields of air.

This a mere poetical flight, indicative of the author's exalted idea of the unbounded power of steam, and deemed, most assuredly, at the time it was written, improbable in all its parts; yet it has in the two first been accomplished. By steam has the slow barge been dragged, and the rapid car driven. It would be difficult to say to what length ingenuity may yet carry it. The probabilities of the present day may be as far exceeded as those of Darwin.

Brande thus introduces it, in connection with mines, "Many of the most important products of the mines of England were unattainable till the Steam Engine, that Giant of Mechanism, rooted them from their subterraneous abodes."

Steam passage vessels have been established all over Britain, with the most unqualified success; in expedition, certainty, and comfort, far exceeding sailing vessels. They start at fixed hours, regardless of wind or tide, and proceed on a direct course, without the inconvenience to passengers of tacking or heeling, which sailing-vessels are liable to, and navigate at the rate of 7 or 8 miles per hour.

Steam waggons are becoming universal in the collieries of Northumberland and Yorkshire; not only is the use of horses superseded in raising water and coals from the mines by steam, but in transporting coals for miles across the country to water carriage—On rail ways, one horse draws two waggons, containing each one Newcastle chaldron (56 cwt.) of coals, besides the waggons, which are one ton each, in all 7 tons 12 cwt. and travels at the rate of 3 miles per hour. A steam waggon draws 9 waggons of coals or 84 tons 4 cwt. and travels at the rate of 6 miles per hour; therefore one steam waggon is equal to 9 horses. The Engineers who have become acquainted with steam waggons, confidently declare it as their opinion, that steam-carriages may be constructed to draw coaches with passengers at the rate of 8 or even 10 miles per hour, and think if the war, had continued and the demand for horses been kept up, that steam coaches would certainly have been tried in Northumberland.

	years.
Marq. of Worcestor's Description of a way to drive up Water by Fire	1663
The first Steam Engine by Savery....	1696
Newcomen's Cylinder Engine	1706
Do. brought to perfection, and applied successfully and universally for draining mines.	1717
No improvement occurred for a period of	47
Watts discovery of condensing the Steam in a seperate vessel	1764
His first Working Engine	1765
Obtained a Patent for 25 years	1774
Obtained a Patent for a rotatory motion with sun and planet wheels, his crank having been pirated, ...	1781
Double working Engine invented, ...	1774
But not executed till exhibited at the Albion Mills, London, together with the rototary motion, ...	1782

No improvement has taken place in principle since 1782, and altho since the expiration of Watts's patent, numberless patents have been taken out, always including Watts's separate condenser, yet they have related entirely to the several working parts, and Watts's original Engine has never been exceeded by any made since.

It is a fact highly flattering to our national character, that the Steam Engine is wholly and solely British. It's invention, with every subsequent improvement, are indisputably the legitimate offspring of the genius of our countrymen. The Marquis of Worcester, Savery, Newcomen, and Watt.

(9) Other modes may be resorted to, to give notice when the water in the boiler is too low, such as a boatswain's whistle or an organ pipe being fixed through the top of the boiler, with the mouth-piece opening under the lowest water-mark, so that whenever the water boils down and uncovers the mouth piece, the steam will blow through and give notice to the attendant.

preserve an equal strength of steam and to prevent a waste of fuel, a door has been contrived to shut down across the flue, when the fire requires to be reduced; this door is called the damper, and ingenuity has taken advantage of the rise of the water in the feed-pipe to make it self-acting. When the steam is strong, it will force the water high up in the feed-pipe, and its surface will invariably correspond with the quality of the steam; so that a float being placed in the feed-pipe, and fastened to the end of a chain passed over a pulley, and balanced with the damper, the steam, when strong, will itself lower the damper, and reduce the fire; and on the contrary, when weak, the damper will rise and increase the draught of the fire, thus regulating itself in a perfect manner. (10)

To enable the Engine Attendant to ascertain the state of the steam, a gage is attached to the boiler, or the steam pipe, which is a bent tube like a syphon reversed, one end communicating with the steam, and the other standing up open to the pressure of the atmosphere. Mercury being poured into the open end, will occupy the lower parts of the tube, and a short stick being inserted will float on the mercury, so that when the steam presses on it in one leg, it will descend, and rise in the other, and carrying with it the stick will point out on a scale or gage, the strength of the steam in the boiler.

It has been ascertained by experiment, that when the safety-valve is loaded with 6lbs. on each square inch of its area, the steam in the boiler will raise mercury in a staight tube against the pressure of the atmosphere, to 12 inches (11) but as a straight tube would be an inconvenient form for a steam-gage, the syphon tube just described is used, and as the divisions from this form must be read double, they are marked in inches, which thus correspond to pounds.

The steam-gage just described, shows the force exerted to move the piston, and it is desirable at the same time to know the state of the vacuum in the condenser, which will materially affect the power of the Engine, according to it's degree of perfection. The vacuum-gage is a barometer, having a small tube communicating from it's top to the condenser, and differing from a common barometer only by deriving it's action from the vacuum of the condenser, whilst that of the common barometer, is effected in the Torricellian manner. When compared with a common barometer, the vacuum-gage, or more frequently called the barometer-gage ought to stand at 28 when the first is at 30 inches, if the Engine be in good order, and the degree of order the Engine may be in, will at all times be indicated by the approach or departure of the mercury from this maximum. The cup at the lower end of the tube must be large enough to contain the whole of the mercury, which will all descend into it when the Engine is at rest. And it is most particularly to be remembered, to cut off the communication from the condenser by the small stop cock, before starting the Engine, otherwise, in the preparatory process of *blowing her through*, the mercury will be thrown out of the cup.

The steam is conveyed from the boiler by a pipe, called the steam-pipe, and is received into a small chamber, from whence there is a communication by means of a four-wayed cock, to the both ends of the cylinder, and also to the condenser; it is contrived in such a manner, that when turned to admit steam to the upper side of the piston, it at the same time opens a communication from the lower side of it to the condenser; the other turn of the cock reverses the communication, admitting the steam to press on the lower side of the piston, and opening the passage from the upper part to the condenser.

(10) A bell may be so hung, that a catch on the chain of the damper shall ring it, on it's being raised to its utmost, to give notice that fuel is required, which is what is called making the Engine ring its own bell for coals.

(11) Pressure of the Steam against the atmosphere, when the Barometer is at 30 inches, or the force which it will exert to escape from a close vessel into the open air.

Column of Mercury.	*Column of Water.*		*Pressure per square Inch.*		*Temperature in degrees of Fahrenheit's Thermometer.*
Inches.	Feet.	Inches.	lbs.	ozs.	
The steam	*equal to the*		*atmosphere*		212 (*boiling*)
1.83	2	0	0	15	215
4.99	5	7	2	7	220
8.20	9	4	4	0	225
11.75	13	4	5	13	230
15.58	17	8	7	11	235
19.67	22	8	9	10	240
23.88	27	0	11	10	245
28.21	31	11	13	14	250
32.85	37	2	16	2	255
37.73	42	8	18	8	260
42.76	48	4	20	15	265
47.85	54	1	23	7	270
53.13	60	1	26	1	275
58.75	66	5	28	13	280
64.35	72	9	31	9	285
70.12	79	3	34	6	290
75.97	85	10	36	10	295
81.81	92	6	40	2	300
87.68	99	1	42	15	305
93.53	105	8	45	14	310
99.29	112	3	49	6	316
105.00	116	5	51	7	320
110.70	125	1	54	4	325

The cylinder is closed with a cover with screws to be taken off when requisite, and the piston-rod, turned truly cylindrical, passes through it, being made steam-tight, and air-tight, by a stuffing-box (two cups, one of them part of the cover, having their edges screwed together with a stuffing of oakum between) and which effectually excludes the passage of steam or air, but permits the piston-rod to pass freely up and down.

The piston has a deep groove in it, for the packing, made of plaited hemp, which is tightly applied and well greased; it must be made to fit the cylinder so closely, that no steam can escape past the sides, and a very ingenious contrivance is made to tighten the packing without unscrewing the cover of the cylinder, by making the piston in two separate parts, so as to admit of the groove for the packing being brought closer together, or in other words reduced in width, which squeezing the packing outwards, has the effect of tightening it; this is done by means of a male-screw cut on the piston-rod, on which the upper half of the piston, works up and down, and by means of a rack it can be turned by a key through the cover of the cylinder.

The air-pump is in every respect like a common water-pump, and may be placed either in the condenser, or be attached to it. The condenser is placed in a cistern of cold water, and a constant renewal of water is kept up by means of another pump, called the cold-water-pump. Besides the condensation produced by the cold water, in contact with the sides of the condenser, a small injection of cold water is requisite to complete the entire condensation of steam in the condenser, and which is admitted from the cistern by a cock called the injection-cock.

As the condensed steam pumped up by the air-pump is now converted into hot water, it is received into a small cistern, which surmounts the air-pump, from whence it is conveyed into the cistern of the feed-pipe for the supply of the boiler, by means of a small force-pump. It will now occur to the reader, that for the sake of technical distinction, the several parts will be called, the cylinder, the condenser, the air-pump, the cold-water-pump, the hot-water-pump, the cold-water-cistern, the hot-water-cistern, &c. &c.

The piston-rod is attached to the end of the beam, (12) which is of cast iron; and as, when put in motion, it describes an arc, whereas the ascent and descent of the piston must be truly vertical, a masterly contrivance to effect this purpose was invented by Mr. Watt, called the parallel motion. It must be merely mentioned here; as to understand it, requires both plates and a model.

The other end of the beam is fastened by a rod to a crank, in the manner of a foot-lathe, which, by the vertical motion of the piston, thus communicated to the crank, produces a rotatory one, and from which every kind of machinery may be worked; a fly-wheel is added to equalize the crank, as usual. This most essential and simple part was not added to the Engine till 85 years after its invention, and forms a prominent feature in its application to the Arts, as without it, it would be confined chiefly to raising water from mines; whereas, with the rotatory motion, it embraces every possible variety of motion required in a first power for the performance of every kind of work.

To turn the cock to work the Engine, a rod is carried from the handle of it to the shaft of the fly-wheel, on which is put an eccentric-wheel; and the end of the rod being made with a ring, is put on the shaft, over the eccentric-wheel, which by the revolving of the shaft is pulled and pushed backwards and forwards, and thus is the Engine made to work itself. The ingenuity displayed by this very simple mode of effecting a most important part, can only be appreciated by those who have followed the progress of of the various complex methods to accomplish the same object.

Regulating the Engine is the finishing stroke, the master-piece of the mechanic art, and causes it to perform its work with the smoothness and regularity of a clock. The regulator is an upwright shaft, on which are fixed, with double joints, two arms furnished with balls at their extremities, which are made to revolve by the Engine: centrifugal force causes the balls to expand, when the motion is quick, and gravity to fall down when it is slow, These two opposite forces with their effects, give a motion, by means of the double-jointed arms, up and down on the shaft of the regulator, which being communicated by a small lever to the steam-pipe, is there attached to a circular value, (called the throttle-valve) working on two centres, fixed in a direction exactly across the passage; and which, by means of the lever just mentioned, is made to open to its full extent, by presenting its edge, or to close the aperture altogether with its superfices; so that when the Engine accelerates its proper speed, the balls expand and close the throttle-valve, lessening the entrance of steam; and on the other hand, when the speed is retarded, the balls fall down and open the throttle-valve, and admit an additional quantity. This master-piece of mechanics, is of primary importance; as without such a check, the enormous power of steam would be merely a most unmanageable and dangerous fury, instead of an obedient and willing slave; for if an Engine which is working with a full load, was, by accident, suddenly relieved of its work, the consequence would be the instant demolition of the Engine, and every thing around it; whereas, in its present state, no one is sensible when the work is taken off or put on: the regulator dealing out the steam to the greatest nicety, and causing the Engine to perform at a fixed rate of speed, under every circumstance.

(12) In lieu of a beam, a cross-bar is placed on the top of the piston, and from each end of it a connecting rod is communicated to the crank, fixed exactly below the cylinder, which is more simple than a beam, and many small Engines are accordingly made thus.

In conclusion, we beg to intimate, that we have studiously adhered to the description of the simplest form and mode of effecting each essential part of the Steam Engine, for the purpose of conveying to the reader with as little technicality as possible, the principle of its action in order that having acquired the rudiments, he will be enabled by himself, to proceed to more elaborate works in the perfectment of his pursuit, when he will perceive a great variety of forms of many of the parts, as well as modes of effecting the several movements of the Engine, branching out from the same principles, which will perhaps at first puzzle him to detect, but ultimately afford him the highest gratification at the developement of exuberant and fanciful variety with which ingenuity can clothe mechanism.

ADDENDA.

It has been Mr. Watt's custom to calculate the power of the Steam Engine by the number of horses supposed to be equivalent to the performance of a similar work; but as the strength of horses differ, there has been much cavilling at the mode he has adopted. Yet as the expression of the power of an Engine in the only other way it could be stated, that of its capability of raising a certain number of pounds in a given time, is not so intelligible, as by a comparison with horses, with which we had been accustomed to perform mill-work, his method has been confirmed; and it is only necessary to make ourselves acquainted with the standard assumed, of the horse-power as the datum for the calculation, to make it perfectly easy and familiar. This by Watt is 32,000 lbs. 1 foot high in a minute, which is ample allowance to cover the variation in the strength, being taken from the large horses of the breweries of the metropolis, and is indeed beyond that of the power of almost any horse. Desaquilier's standard of a horse's power is 27,500 lbs. while Smeaton's is only 22,916 lbs. so that in the expression of the power of an Engine by Mr. Watt's mode, much is in favour of the purchaser, who thus obtains an Engine of greater power than is professed by the justly celebrated inventor and patentee.

To calculate the power of the Steam-Engine, four conditions are requisite.—1st, the area of the piston—2d, the pressure of steam:—3d, the height of the cylinder, or length of the stroke—and 4th, the velocity or number of strokes in a minute, and which last, if the Engine be a double acting one, must be doubled.

Example:—Required the power of a Steam-Engine of 24 inch cylinder, performing 22 double strokes of 5 feet in a minute.—The area of 24 the cylinder, is 452·4, multiplied by 12 lbs. the pressure of steam; multiplied by 22 strokes in a minute; multiplied by 5 feet the length of the stroke; multiplied by 2 double strokes: is 1,194,336, which divided by 32,000, is 37⅓d horses—Brewster.

It will be evident, that any alteration in any of these conditions, will materially affect the power of the Engine. For instance, take an Engine of the same diameter and height of cylinder, calculating the pressure of the steam at 10 instead of 12 lbs. and performing 20 instead of 22 double strokes per minute, the power will be reduced from 37⅓d to 28¼ horses—Thus the area of the cylinder $4524 \times 10 \times 20 \times 5 \times 2 = 904,800$; which, divided by 32,000 is 28¼—Rees.

The authorities published, of the consumption of coals proportionate to the several sized Engines, so as to be enabled to judge of the expence of fuel, are somewhat discordant, varying from 10 lbs. to 30 lbs. per horse-power, per hour. This, however, is not so much to be wondered at, considering the difference in the quality as well as of the quantity of fuel required for any purpose according to the mode of applying it. Rumford's labours in this department need but to be mentioned, to render further comment superfluous.. As a rough estimate, one bushel of 84 lbs. of good coals, per horse power, per working day of eight hours, may be reckoned on.

Mr. Watt. allows 11½ lbs, of coals per horse power, per hour. He also states the performance of his Engines, by the consumption of coals thus. One bushel of Newcastle coals, of 84 lbs. will raise 30 millions lbs of water one foot high: will grind and dress eleven bushels of wheat: will slit and draw into nails, five cwt. of iron: will drive 1000 cotton spindles, with all the preparation machinery; that these effects are equivalent to the work of 10 horses.—Brewster.

One bushel of good pit coals, will raise 480,000 cubic feet of water one foot high, which is more than equivalent to the daily labour of eight men, the value of this coal is seldom so much as that of the work of a single labour for a day, but the expence of a Steam Engine is somewhat more than half the expence of the number of horses, for which it is substituted.—Nicholson.

Watt's Engine will raise more than 24,000 cubic feet of water 24 feet high, for every cwt. of coals consumed.—Robison.

Directions for Starting and Working the Engine.

Move the fly-wheel round, till the crank is level, or a little little above or below it, as you may wish to throw the Engine, the piston being unable to exert any force on the crank till it be at an angle of 45° from the line of its own direction. Fill the cold-water-cistern; prepare the cold-water-pump for work, and shut the cock of the barometer-gage.

The steam by the gage being up to 3 or 4 lbs. turn the handle of the Engine (technically called the hand-geer), so as to fill with steam, the cylinder, the steam passages, the condenser, and the air-pump; this is called blowing the Engine; or "blowing through." The steam will in a second or two blow the air out, with a rattling noise, and occupy its place. Determine the direction you mean to move the piston; turn the handle to admit the steam to press on it accordingly, and let the water into the condenser by the injection-cock; the Engine will immediately move. It may be necessary to reverse the handle once or twice, before the crank will pass the line of the centre; and if you should get the crank up and down, a little help at the fly-wheel will be required to assist it round. One or two turns of it will be sufficient to gain some momentum, when by slipping on the self-working apparatus, all further attention to the handle will be unnecessary.

To regulate the injection-cock, observe that there be just enough water turned on, to prevent steam appearing at the air-pump.

Whilst the Engine is going, be careful to keep all the working parts well oiled. The packing of the piston will require greasing about every three hours, for which melted tallow must be used. To introduce it into the cylinder, there is a screw-plug fitted through the cover, with a cup round it, to receive the tallow; fill this cup, and cautiously unscrew a turn of the plug during the ascent of the piston, and close it again before its descent; reflection will point out, that during the ascent of the piston, the cylinder above it being vacuous, the pressure of the atmosphere on the tallow will force it into the cylinder, but if attempted during its descent, the steam being there pushing the piston down, would also press upwards and blow the tallow out.

To stop the Engine, shut off the injection water, and the power will be immediately reduced; then take the self-working-rod off the handle, when the Engine will necessarily stop; the handle should, however, be laid hold of, and managed to bring the crank to a position ready for starting a-fresh: a little experience will soon give facility and certainty in doing this. Another mode to stop the Engine is to detach the throttle-valve from the regulator, and to shut it, so as to cut off the passage of steam into the Engine altogether. There is a third mode, which is to unload the safety-valve, and let the steam off from the boiler. Most Engines have a lever fitted so as to be enabled to do this easily. At collieries, where it may be material, in order to avoid fatal accidents, to stop the Engine instantaneously, a large lever is fitted to embrace nearly the whole outside of the fly wheel, and which on application stops it *dead* (technical,) but which it is desirable not to practice, except in cases of necessity; the strain caused by this sudden change from a state of motion to that of rest is necessarily great. There is not one case in an hundred where an Engine not instantly stopped can be productive of harm; and therefore, except in the case above mentioned, it is adviseable first to reduce the power, and then to stop the Engine.

The boiler, the main-spring of the Engine, must be well attended to, and taken care of. Be constantly on the watch to see that there are no leaks. Observe that the feeding-apparatus does it duty. Put but a little fuel on the fire at once, and keep the furnace door shut, so that the supply of air to the fire be wholly from the ash-pit. Consult your steam-gage, and keep the steam at an equable strength. Keep the fire and ash-pit clean, and clean the boiler out once a month.

It is material, that the boiler be covered over, and protected from the effects of draughts of wind, and droppings of rain. An instance is recorded of an Engine-boiler which was set in a frail shed at the side of the Engine-house; a shoot of snow from the top of the house fell down and broke through the roof of the shed, and was scattered over the head of the boiler. In an instant, the sides of it were squeezed together by the pressure of the atmosphere.

The rapidity with which steam is condensed is really astonishing. Experiments have been made on steam-vessels of 6 feet in diameter, and 7 feet high, and it has been found that about 4 oz. of water as warm as the human blood will produce a condensation in less than a second.

However solicitous to be brief, we must not omit to mention the only other Engine in principle not already described—This is called the High-Pressure-Engine, and differs from the others so far, that there is no condensation of the steam in it's principle of action. It is fitted with a cylinder and piston, and has the steam to press alternately on each side of it, similar to the Condensing-Engine; whilst, instead of condensation, steam of an highly elastic force is employed, which, being so very much more powerful than the atmosphere, drives the steam out against its pressure, at the opposite end of the cylinder, to which it is admitted—As the steam employed to work the Condensing-Engine, is at 6lbs, whilst that of the High-Pressure-Engine is at 60lbs, on the square inch (whence its name), it cannot fail to strike the reader, that enormous strength and great precision of all the parts must be had, to ensure safety. Indeed it is with Engines of this description chiefly that the accidents by blowing up have happened. For driving carriages, this form seems most desirable, from it's lightness, and few parts, there being neither condenser, air-pump, cold-water-cistern, nor cold-water-pump; but for all other purposes, experienced Engineers seem to agree that the Condensing-Engine is to be preferred—Wherever employed, the High-Pressure-Engine should be attended to, with the most scrupulous care and attention, by a thorough experienced attendant; and as, without such care, it is a highly dangerous machine, it ought not to be meddled with, but by a skilful and able Engineer.

D. S.

Hindoo System.

(From the Friend of India, No. XIII.)

On the Tendency of the Hindoo System to distress and impoverish them.

The tendency of every system of religion given from heaven is invariably to bless mankind. This spirit evidently runs through the whole of even the Mosaic System, although it is the Christian, which most fully proclaims "peace on earth, and good will towards men." While the system given to the Jews however evidently bears marks of its being intended for a people who lived in the infancy of mankind, when relative to civilization, laws and general knowledge, the whole world, as well as the Hebrew nation, spoke and acted like children, still a vein of benevolence runs through the whole: while God is held forth in all his majesty, the duties required by him are defined, the commands given are clear and just, and all apprehension from inferior objects, is both forbidden and removed by the precepts which enjoin the reverential fear of the Supreme Being.

Nor does their religious code contain any means through which an interested priesthood could enrich themselves by working upon the fears and hopes of the people. If a Tenth of the produce of the land was given to one tribe, it should be remembered, that, from this tribe, by the same act of the Divine will, was previously taken and distributed among the other eleven tribes, that part of the land of Canaan which they and their children after them would otherwise have inherited for ever. When therefore, as the condition of receiving this tenth, they were obliged to give up a fair family patrimony in a land flowing with milk and honey, and with it all the enjoyments arising from the transmission to their children from age to age of an independent estate in the most fertile of all lands, there was surely little of personal emolument in the case; nor had the other tribes any great reason to murmur at giving this Tenth to their brethren who instructed them as well in jurisprudence, as in religion, when their own estates were by this arrangement increased to the latest posterity.

Nor indeed were the sacerdotal tribe after thus giving up their own patrimony, *able to compel* their brethren to bring in this tenth for their subsistence. There appears to have been no law given either to priest or Magistrate to *take by force* this tribute from the people; nor even to cut off from the house of God and the worship of the temple, those who were tardy in bringing in these tenths, or who altogether withheld them. The whole appears to have been suspended on the affection, the feeling, the piety of the Hebrew nation. Hence when religion was at a low ebb, the Levites were reduced to the greatest distress: nor does any one among the kings, whether the most pious and devout, or the most profane and tyrannical, appear to have thought of *enforcing* the exact and faithful payment of this *tenth* either to the Levites or the Priests.

Such then was the state of the sacerdotal tribe under the Jewish ecclesiastical polity, which unthinking men have been so fond of representing as the invention of a mercenary priesthood, to enrich and aggrandize themselves. Had this indeed been their object, the event shews that in no instance did men ever fail more completely. The review of their history would almost tempt us to believe, that the arrangement of the Jewish ecclesiastical polity had almost taken from the priests even the desire after wealth and power. While kings abused their power, and inferior magistrates oppressed the people to such a degree, that they are said to "sell the needy for a pair of shoes;" during the whole of the time wherein the nation possessed the land of Canaan prior to the Babylonish captivity, there is no instance of the priesthood's once attempting to engross power and wealth at the expense of the other orders, of the most distant effort to establish an ecclesiastical tyranny; nor an example to be found of one wealthy overgrown ecclesiastic, of a Beauclerc or a Wolsey, the terror of his brethren and the abhorrence of the people. On reviewing the Jewish polity therefore, we are almost compelled to conclude, either that amidst the spirit of rapacity which led to the complete dereliction of all principle among the people in general, the sacerdotal tribe remained the most virtuous of men; or that this system of ecclesiastical polity was so formed, that the desire after power and riches so liberally ascribed to the priesthood, found nothing on which it could possibly feed. If we contrast the Christian church with the Jewish polity, therefore, and recollect the examples of tyranny and self-aggrandizement exhibited by the former, during a course of at least fourteen centuries, the conclusion seems almost to force itself upon us, either that it had not the same Author,—or that men have completely mistaken its very nature.

We turn to the Hindoo system; and here without a hierarchy, without a regular series of ecclesiastics rising in gradation, till the highest shall equal princes and rulers, we behold throughout the whole of their code such an evident tendency to harrass and distress the minds of the people at large, and to aggrandize and enrich the brahmanic tribe, as could scarcely have originated in any thing less than steady design. Had this appeared merely in imposing fines to the ecclesiastical tribe in the form of expiation for certain acts of immorality scarcely cognizable by regular statutes, it might have been ascribed to a benevolent concern in the legislator for the morals and happiness of the people, although the policy which turned the delinquencies of the people to the profit of the sacerdotal tribe, would still have been evident. But in numerous instances, and particularly in one which came before us last month while examining some papers written long since, containing observations on different species of birds found in India, there appeared such an evident wish to harrass and distress the minds of the ignorant with the view of turning this distress to the advantage of the brahmanic tribe, that we thought it ought not to be concealed from the view of our readers. The case occurs when a vulture, &c. by mere accident which it is scarcely in the power of any one always to prevent, happens to perch on the house of some hapless Soodra. The following is the circumstance to which we allude. The Hindoos esteem the vulture and some other birds, to be inauspicious; if one of these birds should perch on a house, it is to be esteemed unclean, till an expiation has been made. The following law upon this subject is extracted from the Vusunta-raja-shakoona.

"If a vulture, a heron, a dove, an owl, a hawk, a gull, a kite, a Bhasha or a Pandura, should settle upon a house, the wife, or a child, or the master of the house, or some other person belonging to him, will die;—or some other calamity will befal him within a year afterwards."

Such then is this law; now for its application in the common course of life, which will at once serve to discover its nature and tendency. To prevent these calamities the house or its value in money must be given to a brahmun. Or the master thereof must offer for a peace offering the following articles: viz. the five productions of the cow; (1) the five gems, viz. gold, silver, chrystal, pearls, and emerald; the five nectareous juices, curds, milk, ghee, sugar, honey; the twigs of the five trees, (2) and the five astringent juices, (3) which are to be put into a pot of water and presented as an oblation. The guardian deities of the quarters of the universe must then be worshipped, and an hundred and eight oblations of ghee made with a Sumidh, or sacrificial piece of the wood of the Kudhira (4) tree, while the muntra of Mrityoonjuya is repeated. The oblation called the muhavyadhee homa is to be performed at the commencement, or at the end of this ceremony. Oblations of ghee, at each of which the gayutree is repeated, are then to be made to Vishnoo, the nine planets, Udbhoota, and the household gods, which being done, the brahmuns must be entertained with ghee and rice milk. It is then required, that the sacrificial fees be paid, and water sprinkled with appropriate muntras; when, assurance being given that all has been duly performed, a prostration is made to the bramuns, and the benediction received from them.

It will be evident on reflection, that this law and its accompanying circumstances, must produce a double effect on the minds of the Hindoos. In the first instance it must fill them with unspeakable anxiety and terror. Calamities the most dreadful to human nature; the loss of a man's dearest relatives, the frustration of all his plans, the wreck of all his substance, he is taught continually to dread, not from the consciousness of some flagrant act of fraud and injustice committed by him, not even from his omission of certain awful and mysterious rites enjoined by the shastras;—but from a circumstance in which he cannot become an agent, respecting which he can exercise no kind of volition, and which it is completely out of his power to prevent—the settling of a dove upon his habitation while he may be reposing after the fatigues of business, or perhaps absent at the imperious call of duty!

Meanwhile this gives the Hindoo to understand; that his neighbour, a brahmun, perhaps fully as ignorant as himself, and far more idle and immoral, has complete power over those circumstances which threaten his property with the most dreadful calamities, and even over the lives of his dearest relatives. What does this involve? Should he view all things as fortuitous, as arising merely from the operation of chance, he is by this law practically taught, that this brahmanic neighbour, excelling himself in nothing but disregard to the dictates of reason and morality, is in reality capable of controuling the most afflictive circumstances,—of averting calamity, and turning aside even the shafts of death itself. But if he regard all things as ruled by destiny and fate; he views this neighbour as exalted above the gods themselves; since if duly propitiated, i. e. feasted and feed, he can controul the laws of destiny, to which even the gods are constrained to bow. Could human cupidity devise a more complete method of enslaving the mind? Let these ideas prevail uncontradicted,—let only a few, submit to these expiatory fines, rather than run the tremendous hazard and the belief in the power of the brahmun is completely confirmed; and from that hour the wealth of his neighbour lies at his disposal. Could the greatest enemy of mankind have devised a more effectual mode of keeping the mind in a state of the most abject debasement? Is it any wonder that with all their ingenuity of understanding, (and in this point they certainly are not behind other nations), the Hindoos should be precisely what we every day witness them to be?

Yet is there no remedy? Is the Hindoo mind consigned to everlasting degradation? Happily there is one remedy, easy of application and effectual in dispelling delusion as the touch of Ithuriel's spear. It is, the dif-

(1) Cow dung, cow's urine, curds, milk, and ghee, with koosha (Poa cynosuroides.)

(2) Twigs of Ficus indica, F. religiosa, F. glomerata, the mango tree, and Mimusops elengi.

(3) Juices obtained by macerating in water, the bark of Eugenia Jambolana Bombax heptaphyllum, Sida Rhomboidea, Zizyphus jujuba, and Sesbana grandiflora,

(4) Acacia Catechu,

fusion of knowledge, and above all of that arising from the Sacred Writings. Let ten, a hundred, a thousand, begin to doubt whether the perching of a dove on a house, be thus inseparably connected with death and unknown calamity, while that of a raven is perfectly innoxious. Let one among these at length venture to risk the dreadful result, by patiently awaiting these threatened calamities; let another imitate his example,—a third,—a fourth,—and the spell is completely broken. The man before regarded as almost more than a god, by the touch of reason is at once disrobed of all his divinity, and reduced to a quiet, harmless mortal, differing in no respect from his neighbours around him. Thus without the least noise or stir, may the diffusion of knowledge dissolve the charm, and free the Hindoo mind from a state of thraldom, hitherto destructive to its peace, its improvement, its moral exertion, beyond the power of language to describe.

Original.

To the Editor of the Calcutta Journal.

Sir,

The accompanying Lines were written by a Friend now no more, if you think them worthy of a place in your Journal they are at your service.

Your Obedient Servant.

Calcutta, Oct. 15, 1819. * * *

SUICIDE.

"When all the blandishments of life are gone,
"The coward sneaks to death; the brave live on."

And what a world is this, where e'en to *be*—
To hold existence—counts as bravery!
Is *this* the Muse's maxim? Is it *thus*
That man is doom'd to feel his Maker's curse?
Weary and spent, yet still forbid to yield;
Conquer'd, yet striving in the hopeless field;
Adversity opposing, garb'd in woe;—
Too brave to fly, since heaven hath will'd it so:
Or, flying, branded with a coward's name,
Scorn'd, or forgotten, or pronounced in shame;
No friendly voice to tell how deep the dart
That drank his life-stream, rankled in his heart;
No pity—no lament—but cast aside
Accurs'd—'a coward and a suicide!'

And is there *no* exception?—See, whom fate
Hath bound to life—that life how desolate!
All that was his, in memory's happier day,
Crush'd by the ruthless hand of destiny!
His hours bereft of all! cheerless, alone,
His sun of joy—that once so bright had shone—
Affection—friendship—love—for ever fled!
She who was *this*, now number'd with the dead!
Her angel voice still heard from forth the tomb,
Aiding his bosom's prayer to share it's gloom!
Her form for ever beckoning to his eye,
Urging his flight to her eternity!

Were this a *coward's* flight?—But, turn! behold
Yon uncomplaining sufferer! Grief untold
Hangs deadly o'er his soul; yet not a sigh,
A tear, a look, betrays the agony,
The nameless anguish that lies hidden there—
The secret, maddening working of despair!
To him too, memory wafts a voice, which, once,
Breathed as from Heaven's tribunal, to announce
That each fond prayer, that angel tongue preferr'd,
Had met acceptance; and, the boon conferr'd,
Celestial joy, e'en here—on earth—was his,
Never to change, but to eternal bliss!
He loved; was loved again; to such excess!—
Such glad, impassion'd, fix'd devotedness!—
And hope so smiled!—and all such promise shed
Of happiness!—Alas! 't was false!—it fled!
All withering sank!—Fell Fate, with blasting breath,
Destroy'd the rapture—but denied the death.—
Yes, still they live: still firm, their post maintain;
Patient till Heaven's decree shall rend their chain,
And call their spirits hence, and end their cares:—
Oh! if there's bravery on earth—'tis their's!

But, had they fled; had agony assail'd
Beyond endurance, and despair prevail'd;
Had every action of their lives, but this;
Confirm'd the hope of future blessedness;
Were every tie dissolved, but that which, now,
On earth alone forbidden, urged the blow;
No friend forsaken; and no trust betray'd;
Themselves alone the victims;—*still* 't were said
They died a *coward's* death; forsook their post
'When all the blandishments of life were lost;'
And *dared* not live;—and not a mortal eye
Had dropt a tear to the fatality;

The blandishments of life!—Alas! how few
Is life permitted in its course to view!
How few the 'coward' who deserts the scene
Leaves to the envied here, whose fate hath been
To win his pittance added to their own,
Yet still unsatisfied, their lot bemoan;
Cling to Delusion's cup so often quaff'd,
Still finding poison mingled in the draught;
Yet linger on, in hope the approaching day
Shall each false promise of the past repay;
And that too gone, content again to rest,
And dream the morrow shall behold them blest;
To-morrow—and again the same is given;
And, thus, from day to day—till pitying Heaven
Sends death to meet the still imploring sigh,
And shews that all it sought was vanity.

The blandishments of life!—There may be some
O'er whom the blight of woe hath never come:
There may be those, who, still content to bear
What others shrunk from, still would tarry here,
In hope, while shuddering at the scenes they 've pass'd,
The wish'd-for haven shall be gained at last.
There may be!—are!—aye, millions! look around!
Take the first casual group that thought hath found;
And analyse the mind of each; and say,
Which dare disown Afflictions' iron sway!
Yet, meet these men of sorrow:—smiles, to win
Belief, that is all slumbering peace within,
Will form a veil that shall deceive e'en you,
Who, tho' you know it false, shall deem it true;
And doubt your very senses, that would see
In such fair seeming, such hypocrisy!

But such is man—strange man! unwilling still
To own the part assign'd by Heaven to fill!
Not one false smiler, 'mid that countless throng
Of those we daily meet, and mix among,
But bears, within, his portion of distress,
And proves the boundless sway of wretchedness!
Virtue, and vice—the simple, and the wise—
The rich, the poor—the soul of enterprize,
The humble—and the proud—the meek—not one
But wears a veil to hide what life hath done!

And, no distinction shown, Fate's blind caprice
Hurries the victim to the sacrifice;
And Heaven, unmoved, beholds the work proceed,
And views each stricken wretch, in silence, bleed.
Were vice the chosen,—misery but endured
By those who err'd,—and virtue still secured
From ill sustain'd by those who sought to win
The goal forbidden, thro' the aid of sin;—
Were this the rule; could Innocence but see
That Justice held the scourge of destiny;
The guilty punish'd; and the good alone
Known as th' elect whom Mercy smiled upon:
Were it but *thus*—Presumptuous man! But, no!
And who art thou, that dar'st to wish it so?
E'en as the thought ascends, the hour is near,
When all the scene thou play'st a part in here
Shall fade; thy hopes—thy joys—thy sorrows—seem
The flitting fancies of an idle dream;
Thy good and ill be weigh'd—thy meekness shown
As these were thine, avail thee; this alone
Decide thy future lot, in Heaven's decree
Of bliss or suffering—through eternity.

Almighty Power! whose will hath placed me here,
Look not in anger on th' unbidden tear
That mourns thy fiat, and implores release,
From this world's bitter trial—ne'er to cease,
But in the grave, where thought shall cease to live,
And memory lose its power!—Oh, hear! Forgive,
If sin it be to kneel, the soul thus riven,
The prayer that soul in anguish breathes to heaven!
And grant what man terms 'bravery,' still to bear
Life's agony, till Mercy call me there!

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